* S E - 6 0 0 9 / 5 0 0 *

SE-6009

B. E. I Examination

April / May – 2011

Engg. Physics

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. I

Name of the Subject :

☛ Engg. Physics

☛ Subject Code No. : 6 0 0 9 ☛ Section No. (1, 2,.....) : Nil

Seat No. :

Student's Signature

(2) Attempt all the questions.

(3) Figures to the right indicate full marks of sub question.

Standard constants :

(1) $h = 6.625 \times 10^{-34}$ Js

(2) $c = 3 \times 10^{8}$ m/s

(3) $\epsilon_0 = 8.854 \times 10^{-12}$ MKS

(4) $m_c = 9.11 \times 10^{-31}$ kg.

(5) $e = 1.6 \times 10^{-19}$ C

(6) $\sigma = 5.67 \times 10^{-8}$ MKS.

(7) $k = 1.38 \times 10^{-23}$ J/mol K

1 (a) Write the answer in short

(1) What is spontaneous emission ?

(2) What is LASER ?

(3) Define the path difference.

(4) Stale the Brewster's law for the polarised light.

(5) State the types of coherence.

(6) What is the condition of diffraction ?

(7) Define the resolving power of grating.

(8) State the important characteristics of laser.

(9) Ruby is _____ with 0.05% of chromium oxide.

(10) State the types of polorised light.

(b) Answer any two questions from the following. **12**

(1) Derive the Einstein's coefficient A and B.

(2) Explain the application of laser in detail.

(3) Explain the construction and working of Michelson's intereferometer

2 (a) Answer any one from following **06**

(1) Explain the construction and working of Ruby laser.

(2) Discuss the characteristics of laser in detail.

(3) Explain the following terms : spontaneous emission population inversion and optical pumping.

(b) Solve any one from the following : **04**

(1) Find the ratio of population of two energy stateof He-Ne laser, the transition between which is responsible for the emission of photons of wave length $6328A^0$. Assume temperature as 20^0 K.

(2) The ratio of population of two energy levels out of which upper one corresponds to metastable state 1.06×10^{-30}. Find the wave length of light emitted at temperature T = 300^0 K.

3 (a) Answer any **two** from the following : **12**

(1) Explain the term interference. Derive the equation for intensity at a point for the Young's double slit experiment.

(2) State and derive Malv's law for the polarised light.

(3) Describe the diffraction at circular aperture. Explain Reyleigh's condition for the image resolution.

(b) Solve any **two** from the following : **06**

(1) A water film ($\mu = 1.33$) in air is $3200A^0$ thick if it is illuminated with white light of normal incidence, what color will apper in reflected light ?

(2) A converging lens 3.0 cm in diameter has focal length of 20 cm. What angular separation must distant point objects have to satisfy Reyleigh's condition. Assume $\lambda = 5500A^0$

(3) When unpolarised light is incident on the transparent material of polarising angle, the deviation due to reduction in transmitted beam is 24^0. Calculate the refractive index of material.

4 (a) Write the answer in short : **10**

(1) Define spectral radiancy.

(2) Write the unit of the magnetic field.

(3) State Bragg's equation for the X-ray diffraction.

(4) What is main use of Hall effect ?

(5) State Ampere's law.

(6) What do you mean by black body.

(7) What is the Compton shift for the scattering angle

$\phi = 90^0$

(8) Write the Stephan's fourth power law.

(9) Give the example of ferromagnetic medium.

(10) What do you mean by solenoid.

(b) Answer any **two** from the following : **12**

(1) Explain the construction and working of Betatron.

(2) What do you mean by Hall effect ? Derive the equation for Hall voltage.

(3) Explain Hydrogen atom spectrum.

5 (a) Answer any **one** from the following. **06**

(1) State and prove Ampere's theorem and explain any one application.

(2) Classify the magnetic materials from the magnetic properties and mention their magnetic behaviour.

(b) Solve any **one** from following : **04**

(1) A monovalent metal strip 1 cm wide and 0.5 cm thick is placed in magnetic field B = 1.2 tesla. If current of 50 Amp is set up in strip, what Hall potential difference appear across the strip ? ($n = 8.4 \times 10^{28}$)

(2) Calculate magnetic induction ($\vec{B}$) at interior point $\ell = 70\ cm$ of a toroid having winding of 1000 turns and current 5000 mA.

6 (a) Answer any **two** question from the following : **12**

(1) Explain the main features of photoelectric effect and also obtain Einstein's photoelectric equation.

(2) State and derive Bragg's X-ray diffraction equation for the crystal lattice.

(3) Define matter waves. Discuss the De-Broglie hypothesis for the matter wave.

(b) Solve any **two** from the following : **06**

(1) Photoelectric threshold of metalic silver 1.1 eV. Determine whether the metal shows phtoelectric effect for the wavelength $5700A^0$?

(2) X-ray with $\lambda = 1 \times 10^{-8}$ cm. are scattered from carbon block. The scattered radiation are viewed at 60^0 to the incident beam. What is the Compton's shift ?

(3) A mass spring system hass mass = 1.5 kg and spring constant K = 15N/m and is oscillatory with an amplitude of 1.0 cm. If energy is quantized, which is quantum number ?
